A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Prior Application: 08/765,836
Examiner: G. Cantelmo
Art Unit: 1753

Hon. Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

This is a request for filing a [ ] continuation [X] divisional [ ] continuation-in-part under 37 C.F.R. § 1.53 (b) of pending prior application Serial No. 08/765,836, filed on January 14, 1997 of Migaku Takahashi for MAGNETIC THIN FILM AND PRODUCTION METHOD THEREFOR

1. a. [X] Enclosed is a copy of the prior application, including the oath or declaration as originally filed and an affidavit or declaration verifying it as a true copy.

   b. [ ] Enclosed is a revised specification which differs from the specification in the prior application to clarify the text but does not include new matter and the oath or declaration as originally filed.

   c. [ ] Enclosed is a new specification which includes additional new subject matter and a new oath or declaration.

2. [X] The filing fee is calculated as follows:

CLAIMS AS FILED IN THE PRIOR APPLICATION, PLUS ANY CLAIMS ADDED AND MINUS ANY CLAIMS CANCELED BY PRELIMINARY AMENDMENT BELOW

	Number Filed		Number Extra		Rate		Basic Fee
							$760.00
Total Claims	4	-20 =	0	x	$18.00	=	$
Independent Claims	2	-03 =	0	x	$78.00	=	$
Multiple Dependent Claims				x	$260.00	=	$
Total of Above Calculations							$ 760.00
Reduction of ½ for filing by small entity, if applicable. A small entity statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).							$ 380.00
Total Fees Enclosed							$ 380.00

3. [X] A check in the amount of $ 380.00 is enclosed. (Check No. 2218)

4. [ ] Amend the specification by inserting before the first line the sentence: --This is a divisional of Serial No. 08/765,836 filed January 14, 1997.--

5. [X] New informal drawings are enclosed.

6. [ ] The prior application is assigned of record to

7a. [ ] A new combined declaration and power of attorney is enclosed.

b. [X] A copy of the Power of Attorney as it appears in the original papers in the prior Application is enclosed.

8. [X] Associate Power of Attorney is enclosed.

9. Address all future communications to:

Stephen J. Weyer
RANDALL J. KNUTH, P.C.
3510-A Stellhorn Road
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Telephone: 219-485-6001
Facsimile: 219-486-2794

10. [X] A preliminary amendment is enclosed. (Claims added by this amendment have been properly numbered consecutively beginning with the number next following the highest numbered original claim in the prior application.)

11. [X] I hereby verify that the attached papers are a true copy of prior application Serial No. 08/765,836 as originally filed on January 14, 1997.

The undersigned declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

3/16/99
Date

Stephen J. Weyer
Registration No. 43,259

SJW/cb

Encs: Application
Drawings
Preliminary Amendment
Declaration (copy)
Associate Power of Attorney (copy)
Check No. 2218 ($380)
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	)	
Takahashi Migaku	)	Group:
Serial No.:	)	
Filed:	)	Examiner
Title: MAGNETIC THIN FILM AND PRODUCTION METHOD THEREFOR	)	

PRELIMINARY AMENDMENT

Hon. Commissioner of Patents
and Trademarks
Washington, D.C. 20231

Sir:

Please enter the following Amendments to the application prior to calculating the filing fee.

IN THE CLAIMS

1. A magnetic thin film [, characterized in] comprising:

an iron nitride thin film having a nitrogen martensite α' phase with α (002) surface formed on a substrate using an opposed-target DC sputtering method by means of reactive sputtering with N_2 gas;

said α' phase having diffraction rays observed from only said α (002) surface.

2. A magnetic thin film[, characterized in that] comprising:

iron (α - Fe) thin films and iron nitride thin films [are] alternately deposited on a substrate by means of an opposed-target DC sputtering method, said iron nitride thin films having a nitrogen martensite α' phase with α (002) surface, said α' phase having diffraction rays observed only from said α (002) surface.

Please delete Claims 3-9.

10. The magnetic thin film in accordance with Claim 1, in which said iron nitride thin film contains an α" crystalline phase ($Fe_{16}N_2$) with said α' phase.

11. The magnetic thin film in accordance with Claim 2, in which said iron nitride thin films contains an α" crystalline phase ($Fe_{16}N_2$) with said α' phase.

Respectfully submitted,

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APPLICANT OR PATENTEE: Migaku TAKAHASHI

SERIAL NO. OR PATENT NO.: 08/765,836

ATTORNEY DOCKET NO.: FUK0012.US

FILED OR ISSUED: January 14, 1997

TITLE: MAGNETIC THIN FILM AND PRODUCTION METHOD THEREFOR

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) and 1.27(b)) - INDEPENDENT INVENTOR

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled:

MAGNETIC THIN FILM AND PRODUCTION METHOD THEREFOR

described in:

[ ] The specification filed herewith

[X] Application Serial No. 08/765,836, filed 01/14/1997.
[ ] Patent No. _____, issued _____.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

[X] no such person, concern, or organization

[ ] persons, concerns, or organizations listed below *

* NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities (37 CFR 1.27).

FULL NAME: _____
ADDRESS: _____
[ ] INDIVIDUAL [ ] SMALL BUSINESS CONCERN [ ] NONPROFIT ORG.

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate (37 CFR 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Magaku TAKAHASHI
NAME OF INVENTOR

M. Takahashi
SIGNATURE OF INVENTOR

14th. May. 1997
DATE

SPECIFICATION

MAGNETIC THIN FILM AND PRODUCTION METHOD THEREFOR

Technological Field

The present invention relates to a magnetic thin film and a manufacturing method therefor; in particular, the present invention relates to a manufacturing method for thin magnetic films which is capable of stably producing an iron nitride film having high saturation. The present invention may be advantageously applied to the magnetic heads or the like of magnetic discs having high recording density.

Background Art

Iron nitride thin films, in particular, $Fe_{16}N_2$ thin films, have a particularly large saturation among magnetic materials, and have attracted attention as new materials which may be finely worked for magnetic head materials and the like; however, because these materials are not stable with respect to heat, the formation of thin films under high temperatures with such materials is impossible, and the stable formation of thin films having superior characteristics has become difficult. However, in recent years, Omuro et al. (Journal of the Japanese Society of Applied Magnetism, 14, 701, 1990) have made it possible to produce a monocrystalline iron nitride film ($Fe_{16}N_2$) using the MBE method, and since the enormous value of the magnetic moment

of such a thin film has been confirmed, these materials have again attracted attention, and a manufacturing method which is capable of application has been anticipated.

However, the following problems exist in this manufacturing method: (1) a special substrate ($In_{0.2}Ga_{0.8}As$) is required, (2) the film formation rate is slow (0.05Å/sec or less), (3) the critical film thickness in the single phase state of the stably formed $Fe_{16}N_2$ is small (1000Å or less), and (4) the process of the nitridization of the Fe from the gas phase is unclear, and instabilities remain in the thin film formation; thus, the current state of affairs is such that there are great obstacles to the application of iron nitride thin films.

In light of the above circumstances, the present invention has as an object thereof to provide a magnetic thin film formation method which is capable of rapidly and stably forming an iron nitride thin film present in a single phase state while at a film thickness of 1000Å or more, and which does not not require a special substrate. Furthermore, the present invention has as an object thereof to provide a magnetic thin film having high saturation and a low coercive force.

Disclosure of the Invention

With respect to a stable formation method for iron nitride thin films, the attention of the present inventors was drawn to the use of a reactive plasma of N_2 gas; they have developed

experiments relating to standardized plasma analysis and the process of nitridization by means of a vapor deposition method and sputtering method, and have investigated the relationship between the plasma and the iron nitride thin film phase which is synthesized. The present inventors have selected the plasma conditions and produced the iron nitride thin film on a substrate by means of an opposed-target DC sputtering method have made clear the growth conditions of α'' - $Fe_{16}N_2$, and they have considered the relationships between the phase, the structure, and the saturation. The present invention was completed based on these insights.

That is say, the magnetic thin film of the present invention is characterized in comprising an iron nitride thin film which is formed on a substrate by means of an opposed-target DC sputtering method employing reactive sputtering with N_2 gas.

Furthermore, the present invention is characterized in that by means of the opposed-target DC sputtering method, an iron (α - Fe) thin film and a iron nitride thin film are alternately layered on a substrate.

Furthermore, the magnetic thin film manufacturing method in accordance with the present invention is a manufacturing method for iron nitride thin films which employs an opposed-target DC sputtering method, characterized in that iron nitride thin film is formed on a substrate by introducing Ar and N_2 gases into a

film formation chamber, and applying DC power to an iron target within the Ar and N_2 gas atmosphere.

In a preferred mode of the manufacturing method of the present invention, the flow rate of the N_2 is within a range of 8 - 25% of the total gas flow rate.

Furthermore, it is preferable that the electron temperature during formation of the iron nitride thin film be within a range of 0.01 - 1 eV, and that the electron density be within a range of $1 \times 10^9 - 1 \times 10^{10}$ cm^{-3}.

Furthermore, in a preferred mode of the present invention, the substrate has an iron thin film formed thereon as a base layer.

Additionally, in the present invention, it is preferable that after the formation of the iron nitride thin film, heat treatment be conducted in a vacuum, and it is preferable that the heat treatment be such that the temperature is within a range of 100 - 180° C, and the treatment is conducted for a period within a range of 1 - 3 hours.

Function

By means of the present invention, it is possible to rapidly and stably form an iron nitride thin film having an extremely large saturation Ms, by means of employing an opposed-target DC sputtering method. Additionally, by means of setting the electron temperature and electron density during film formation to within ranges of, respectively, 0.01 - 1 eV and 1 x

10^9 - 1 x 10^{10} cm^{-3}, it is possible to further increase the uniformity and stability of the characteristics of the film, such as saturation and the like.

By means of setting the flow rate of the N_2 gas to within a range of 8 - 25% of the total gas flow rate, it is possible to more stably form the single phase α crystalline phase.

Furthermore, it is preferable that an iron thin film (α - Fe) be formed as a base layer on the substrate. By means of employing such a substrate, the monocrystalline nature of the thin film is further increased.

Additionally, it is preferable that after the iron nitride thin film formation in the present invention, heat treatment be carried out in a vacuum, and it is preferable that the conditions of the heat treatment be such that the temperature is within a range of 100 - 180° C, and the treatment is carried out for a period of time within a range of 1 - 3 hours. By means of conducting heat treatment, it is possible to produce an α" crystalline phase ($Fe_{16}N_2$) and to further increase the saturation.

By providing a layered structure of α - Fe and iron nitride in the magnetic thin film in accordance with the present invention, it is possible to reduce the coercive force.

Brief Description of the Drawings

Figure 1 is a graph showing the relationship between the X-ray diffraction pattern of the iron nitride thin film after film

formation, and the flow rate ratio of the N_2 gas during film formation.

Figure 2 is a graph showing the X-ray diffraction pattern of the iron nitride thin film after heat treatment.

Figure 3 is a graph showing the changes in the X-ray diffraction pattern of the iron nitride thin film immediately after film formation and after heat treatment.

Figure 4 is a graph showing the relationship between the amount of N contained in the α'' and α' phases, and the flow rate ratio of the N_2 gas during film formation.

Best Mode for Carrying Out the Invention

Hereinbelow, the present invention will be explained in detail based on embodiments; however, it is of course the case that the present invention is in no way limited to the embodiments described.

(Embodiment 1)

The film formation of the iron nitride thin film was conducted by means of an opposed-target DC sputtering method under conditions such that the total gas pressure was 5 mTorr, the total gas flow rate was 5 ccm, and the N_2 gas flow rate ratio was within a range of 2 - 25%. A MgO (001) monocrystalline substrate was employed as the substrate, and prior to film formation, the substrate was subjected to heat treatment for a period of 2 hours at a temperature of 200° C

within a chamber, and was then allowed to cool to room temperature.

First, an iron base layer having a thickness of 50Å was formed in a Ar atmosphere (at a film formation rate of 33Å/min), and on this, an iron nitride thin film having a thickness of 3000Å was formed in a Ar and N_2 gas atmosphere, at a film formation rate of 200Å/min. Film formation was conducted under conditions such that the electron temperature Te was equal to 0.3 eV and the electron density Ne was equal to 1×10^{10} cm^{-3}; these were determined on the basis of plasma diagnostic results.

After film formation, heat treatment was conducted by temporary exposure of the thin film to the atmosphere, and then heating at a temperature of 150° for a period of 2 hours at a pressure of 5×10^{-6} Torr in a vacuum furnace.

The structural analysis was conducted by means of X-ray diffraction (CoKα rays). Furthermore, the amount of N contained in the thin film as determined from the relationships between the lattice constant and the N concentration at the nitrogen marten-site which were disclosed by Jack (Proc. Roy. Soc., A208, 200, 1951).

In Figure 1, the X-ray profiles of a series of iron nitride thin films produced with N_2 flow rate ratios within a range of 2 - 25%, immediately after film formation, are shown. Furthermore, in the Figure, the N concentration corresponding to each diffraction line is also shown.

In the profiles on the large angle side in which $65° < 2\theta < 80°$, diffraction rays were only observed from the (002) surface of the nitrogen marten-site α' phase (hereinbelow abbreviated to α(002)), in which N atoms were arranged irregularly in the body-centered cubic lattice of the iron nitride.

It was determined that the thin film produced at N_2 gas flow ratios of 5% or less comprised two phases, α - Fe and the α' phase, while thin films produced at 8% or more comprised only the single α' phase. Additionally, in concert with the increase in the N_2 gas flow rate ratio, the diffraction rays from the α' (002) moved in the direction of the smaller angles, from 75° to 68°, and this corresponds to an increase in the amount of N contained in the α' phase.

In Figure 2, X-ray profiles of the thin films shown in Figure 1, obtained after heat treatment, are shown. It can be seen from the profiles on the large angle side that the diffraction rays from the α' which was grown in a nearly single phase state immediately after film formation are clearly separated from the diffraction rays from the α' phase (002) surface containing approximately 2 - at% of N, and the diffraction rays from the α" phase (004) surface (hereinbelow shortened to α" (004)) and the α' phase (002) surface containing approximately 11 at% N. Additionally, furthermore, in the small angle side profiles, the diffraction rays from the α" (002) surface (hereinbelow shortened to α" (002)), which are the

diffraction rays unique to the α" phase, are clearly observed in the thin films produced with N_2 gas flow rate ratios of 12% or greater during film formation. These diffraction rays are produced when a regular arrangement of N atoms is selectively caused in the $Fe_{16}N_2$ phase. From this, it is thought that, although a body-centered cubic structure is maintained in the thin films prior to heat treatment, the N atoms are not in a regular arrangement, and that such a regular arrangement of the N atoms is promoted by heat treatment, thus producing the α" phase.

It was confirmed that the α" layer is essentially not formed at heat treatment temperatures of 100°C or less.

In Figure 3, in order to consider in greater detail the state of the phase separation from the α' to the α" + α' seen in Figure 2, the patterns of change in the diffraction rays at large angles, before and after heat treatment, in thin films produced under various flow rate ratios are shown. In those prior to heat treatment, it can be seen that the α' single phase is present in all thin films (the single dotted line in the Figure). The changes after heat treatment are such that, using as an example the profile of the thin film produced using a N_2 gas flow rate ratio of 12%, the α' phase prior to heat treatment, which is assumed to contain 8.5 at% N, is divided after heat treatment into the α" and α' phases having a large amount of N contained, at 10.6 at%, and the α' phase having a small amount of N contained, at 1.3 at%. Similar trends in the

changes were observed in the thin films produced using all other N_2 gas flow rate ratios. In the thin film produced using a N_2 gas flow rate ratio of 25%, diffraction rays from a γ' phase were observed. On the other hand, in the thin films after heat treatment, the intensity ratio $I_{\alpha'(002)}/I_{\alpha''(004) + \alpha'(002)}$ between the diffraction rays from the α' phase (002) surface containing approximately 2 at% N, and the diffraction rays from the α'' (004) and a'(002) having the $Fe_{16}N_2$ stoichiometric composition (approximately 11 at%) decreases as the N_2 gas flow rate ratio increases; this is believed to show that the amount of α'' phase containing 11 at% of N which is generated in the film is increasing.

In Figure 4, based on the X-ray profiles shown in Figures 1 and 2, the amounts of N contained in each phase are shown with respect to the N_2 gas flow rate ratio during film formation. Immediately after film formation, the amount of N contained increases monotonically from 2.5 to 12.5 at% in concert with an increase in the N_2 gas flow rate ratio. On the other hand, as a result of the heat treatment, in the films produced using N_2 gas flow rate ratios of from 10 to 16%, the α' phase (7.5% - 11 at% N) prior to heat treatment is divided into an α'' containing a large amount of N and an α' containing a small amount of N. The N concentration within the α'' phase remains in the stoichiometric ratio of the $Fe_{16}N_2$ compound as the N_2 gas flow rate ratio increases, and shows a tendancy to be essentially saturated. Furthermore, in the thin films formed using a N_2 gas

flow ratio of 25%, as a result of heat treatment, a γ' - Fe_4N phase (stoichiometric composition 20 at%) is formed.

As described above, in accordance with the present invention, it was confirmed that it is possible to form an iron nitride thin film having a high saturation. In particular, when a N_2 flow rate ratio of 8% or more is employed, it is possible to form a single phase α' phase, and it is thus possible to form an iron nitride thin film having more stable characteristics. Additionally, it was learned that by means of conducting heating treatment, an α'' phase having a higher saturation was formed.

(Embodiment 2)

In the same manner as in Embodiment 1, iron thin films having a thickness of 30Å and iron nitride thin films having thickness of 100Å were alternately layered on a MgO substrate so that 5 of each type of layer was present. The N_2 gas flow rate ratio during deposition of the iron nitride thin film was 20%.

After this, heat treatment was conducted in a vacuum furnace at a pressure of 5×10^{-6} Torr or less, at a temperature of 150°C, and for a period of 2 hours.

When the coercive force of the magnetic thin films obtained was measured, it was determined to be 1.0 Gauss, and it was thus learned that by means of employing the present embodiment, it is possible to obtain magnetic thin films having extremely low coercive forces.

Industrial Applicability

As described above, in accordance with the invention as stated in claim 1, it is possible to provide magnetic thin films having high saturation. Additionally, by means of the invention as stated in claim 2, it possible to provide magnetic thin films having low coercive force.

By means of the magnetic thin film manufacturing method as stated in claim 3, a high speed film formation of 200Å per minute is possible, and moreover, it is possible to produce iron nitride thin films which are single phase and have high saturations even when extremely thick in comparison with those conventionally obtainable, at 3000Å.

Additionally, in accordance with the invention as stated in claim 8, it is possible to produce a α" phase having higher saturation.

By means of the present invention, it is possible to provide thin film magnetic heads appropriate for ultra high recording densities.

CLAIMS

1. A magnetic thin film, characterized in comprising an iron nitride thin film formed on a substrate using an opposed-target DC sputtering method by means of reactive sputtering with N_2 gas.

2. A magnetic thin film, characterized in that iron (α - Fe) thin films and iron nitride thin films are alternately deposited on a substrate by means of an opposed-target DC sputtering method.

3. A magnetic thin film manufacturing method comprising a manufacturing method for iron nitride thin films employing an opposed-target DC sputtering method, characterized in that Ar and N_2 gases are introduced into a film formation chamber, DC power is applied to an iron target in the Ar and N_2 gas atmosphere, and an iron nitride thin film is formed on a substrate.

4. A magnetic thin film manufacturing method in accordance with claim 3, characterized in that a flow rate of said N_2 gas is within a range of 8 - 25% with respect to the total gas flow rate.

5. A magnetic thin film manufacturing method in accordance with one of claims 3 and 4, characterized in that the electron temperature during the formation of the iron nitride thin film is within a range of 0.01 - 1 eV, and the electron density is within a range of 1×10^9 - 1×10^{10} cm^{-3}.

6. A magnetic thin film manufacturing method in accordance with one of claims 3 through 5, characterized in that said substrate has an iron (α - Fe) thin film (001) surface formed thereon as a base layer.

7. A magnetic thin film manufacturing method in accordance with one of claims 3 through 6, characterized in that after iron nitride thin film formation, heat treatment is conducted in a vacuum.

8. A magnetic thin film manufacturing method in accordance with claim 7, characterized in that the conditions of said heat treatment are such that the temperature is within a range of 100 - 180° C, and treatment is conducted for a period of time within a range of 1 - 3 hours.

9. A magnetic thin film manufacturing method in accordance with one of claims 3 through 8, characterized in that said iron nitride thin film contains an α" crystalline phase ($Fe_{16}N_2$).

ABSTRACT

This invention is directed to provide a thin film of iron nitride of high saturation and low coercive force and a method of forming stable at a high speed a thin film of iron nitride without requiring any specific substrate.

The method of the present invention uses an opposed-target DC sputtering method, in which Ar and N_2 gasses are introduced into a film formation chamber, DC power is applied to iron targets in the Ar and N_2 gasses and a thin film of iron nitride is formed on a substrate. A heat treatment is carried out in vacuum after the formation of the thin film.

Fig. 1

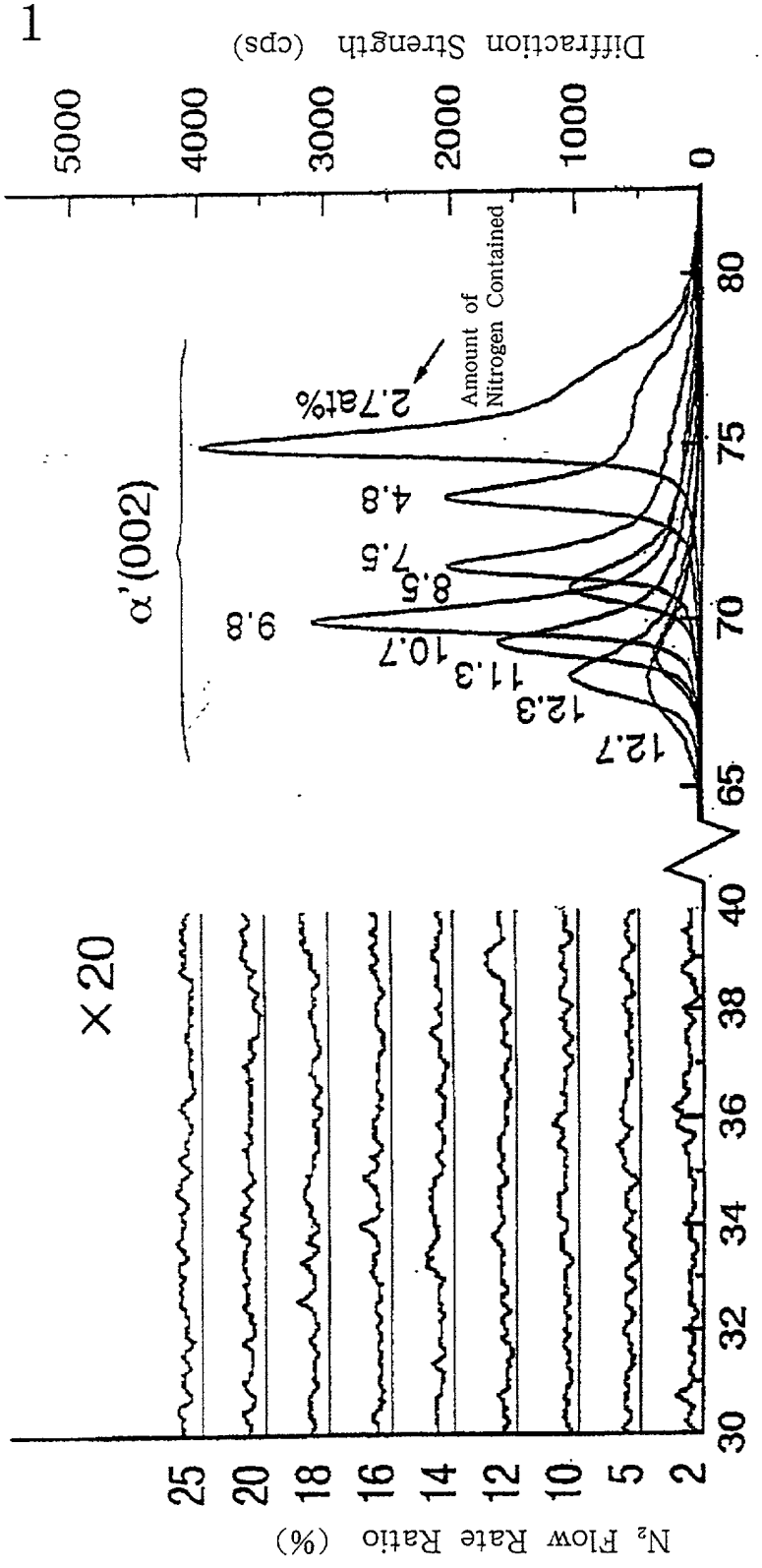

N2 Flow Rate Ratio (%)
25
20
18
16
14
12
10
5
2
30
32
34
36
38
40
65
70
75
80
Diffraction Angle (2θ)
Diffraction Strength (cps)
5000
4000
3000
2000
1000
0
α'(002)
×20
2.7at%
Amount of Nitrogen Contained
4.8
7.5
8.5
9.8
10.7
11.3
12.3
12.7

Fig. 2

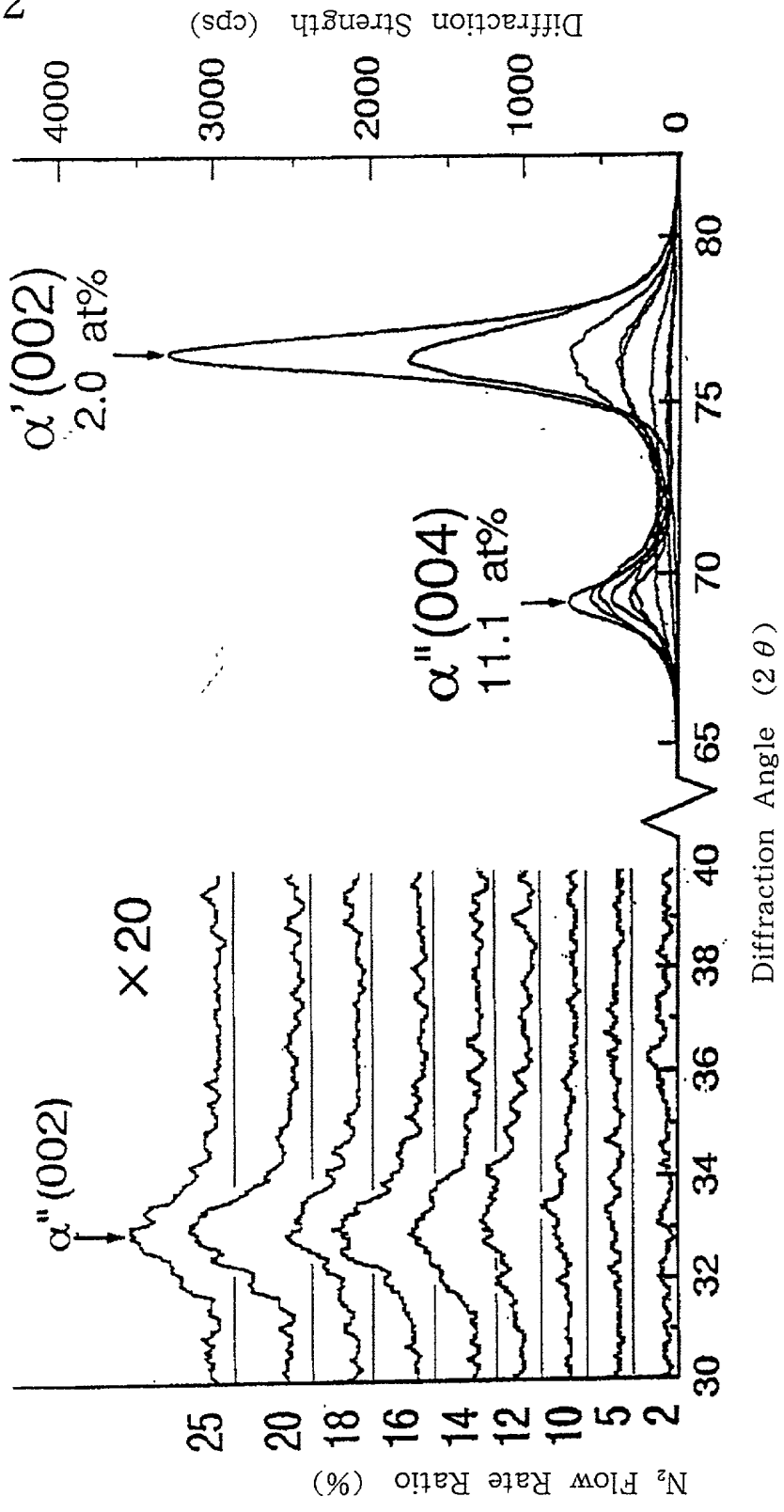

Diffraction Strength (cps)
4000
3000
2000
1000
0
α'(002)
2.0 at%
α"(004)
11.1 at%
α"(002)
× 20
N2 Flow Rate Ratio (%)
25
20
18
16
14
12
10
5
2
30
32
34
36
38
40
65
70
75
80
Diffraction Angle (2θ)

Fig. 3

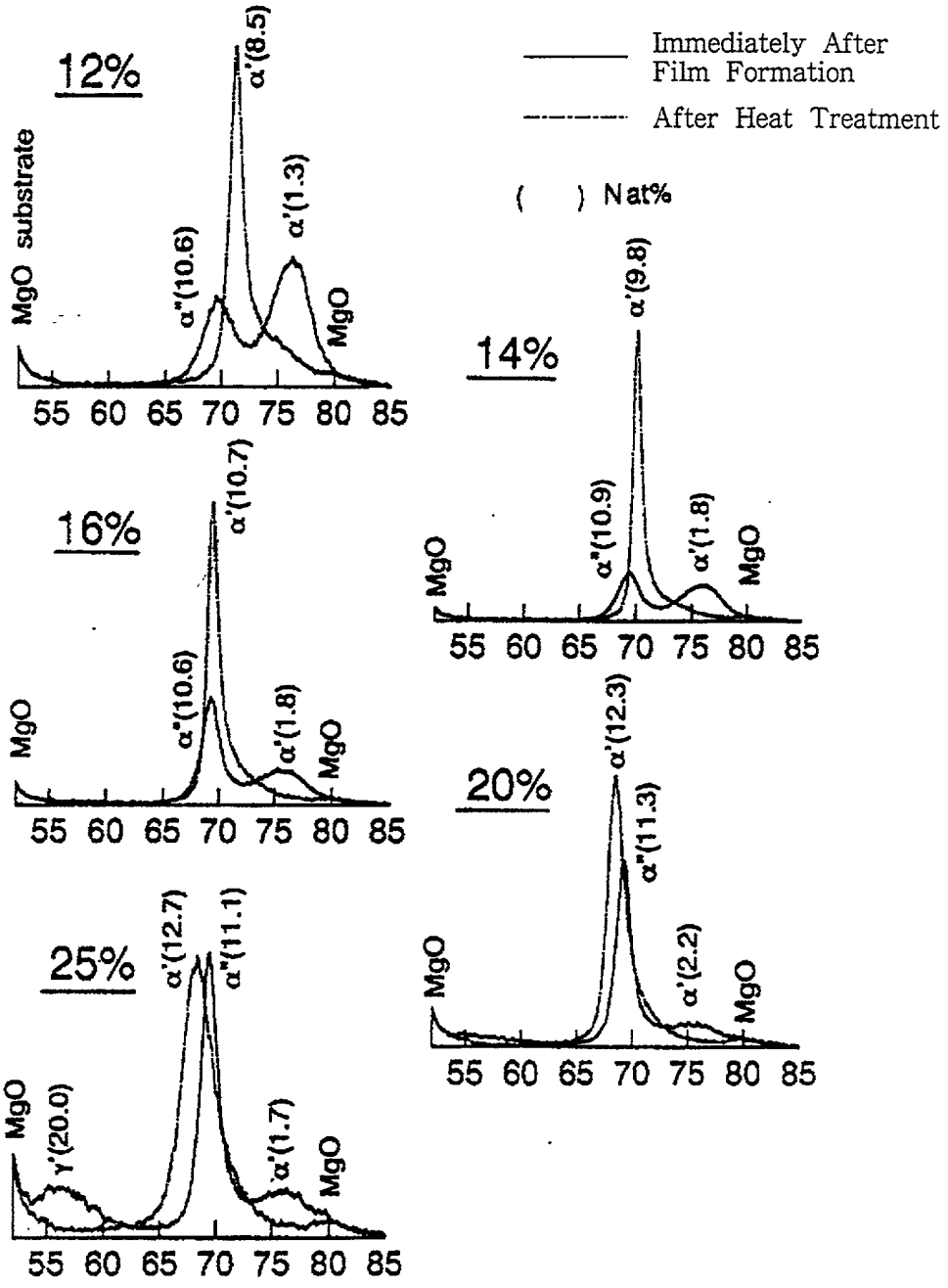
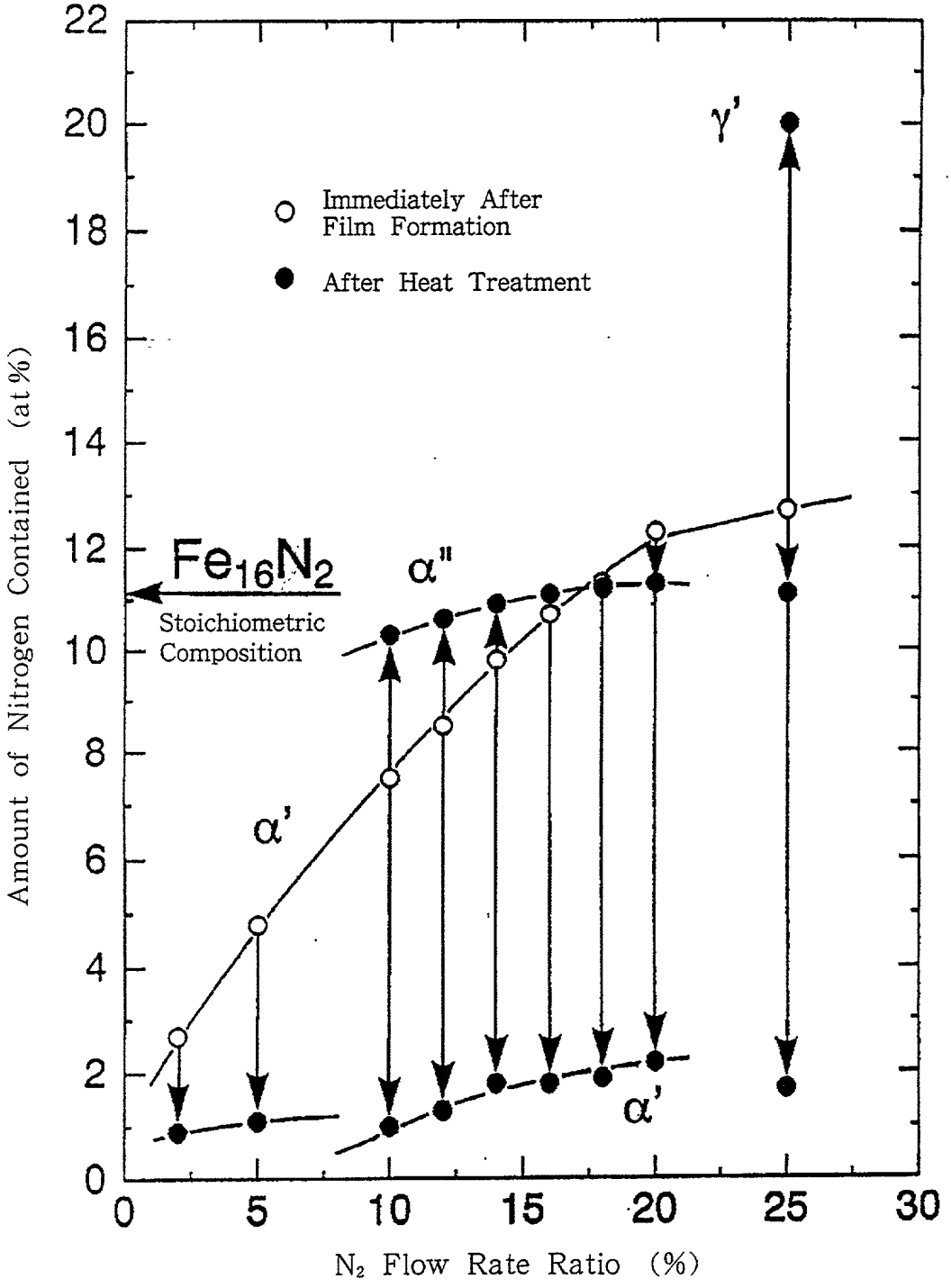

N₂ Flow Rate Ratio (%)
Immediately After Film Formation
After Heat Treatment
( ) Nat%
12%
MgO substrate
α"(10.6)
α'(8.5)
α'(1.3)
MgO
14%
α'(9.8)
α"(10.9)
α'(1.8)
MgO
16%
α'(10.7)
α"(10.6)
α'(1.8)
MgO
20%
α'(12.3)
α"(11.3)
α'(2.2)
MgO
25%
α'(12.7)
α"(11.1)
γ'(20.0)
α'(1.7)
MgO
55 60 65 70 75 80 85

Fig. 4


Amount of Nitrogen Contained (at %)
N₂ Flow Rate Ratio (%)
Immediately After Film Formation
After Heat Treatment
Fe16N2
Stoichiometric Composition
α'
α"
γ'
0
2
4
6
8
10
12
14
16
18
20
22
0
5
10
15
20
25
30

Declaration and Power of Attorney For Patent Application

特許出願宣言書

Japanese Language Declaration

私は、下欄に氏名を記載した発明者として、以下のとおり宣言する：

私の住所、郵便の宛先および国籍は、下欄に氏名に続いて記載したとおりであり、

名称の発明に関し、請求の範囲に記載した特許を求める主題の本来の、最初にして唯一の発明者である（一人の氏名のみが下欄に記載されている場合）か、もしくは本来の、最初にして共同の発明者である（複数の氏名が下欄に記載されている場合）と信じ、

□ _____

□ _____

□ _____

その明細書
（該当する方に印を付す）

□ ここに添付する。

□ _____ 日に出願番号

第 _____ 号として提出し、

_____ 日に補正した。

（該当する場合）

私は、前記のとおり補正した請求の範囲を含む前記明細書の内容を検討し、理解したことを陳述する。

私は、連邦規則法典第37部第１章第56条（ａ）項に従い、本願の審査に所要の情報を開示すべき義務を有することを認める。

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

MAGNETIC THIN FILM AND PRODUCTION METHOD THEREFOR

the specification of which

(check one)

☐ is attached hereto.

☒ was filed on January 14, 1997 as

Application Serial No. _____

and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Japanese Language Declaration

私は、合衆国法典第35部第119 条にもとづく下記の外国特許出願または発明者証出願の外国優先権利益を主張し、さらに優先権の主張に係わる基礎出願の出願日前の出願日を有する外国特許出願または発明者証出願を以下に明記する：

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior foreign applications 先の外国出願 (Number) (番　号)	(Country) (国　名)	(Day/Month/Year Filed) (出願の年月日)	Priority claimed 優先権の主張 Yes あり	No なし
PCT/JP94/01173	Japan	July 18, 1994	☒	☐
			☐	☐
			☐	☐

私は、合衆国法典第35部第120 条にもとづく下記の合衆国特許出願の利益を主張し、本願の請求の範囲各項に記載の主題が合衆国法典第35部第112 条第１項に規定の態様で先の合衆国出願に開示されていない限度において、先の出願の出願日と本願の国内出願日またはＰＣＴ国際出願日の間に公表された連邦規則法典第37部第１章第56条（ａ）項に記載の所要の情報を開示すべき義務を有することを認める：

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United Sates Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.) (出願番号)	(Filing Date) (出願日)	(現　況) (特許済み、係属中、放棄済み)	(Status) (patented, pending, abandoned)

私は、ここに自己の知識にもとづいて行った陳述がすべて真実であり、自己の有する情報および信ずるところに従って行った陳述が真実であると信じ、さらに故意に虚偽の陳述等を行った場合、合衆国法典第18部第1001条により、罰金もしくは禁錮に処せられるか、またはこれらの刑が併科され、またかかる故意による虚偽の陳述が本願ないし本願に対して付与される特許の有効性を損うことがあることを認識して、以上の陳述を行ったことを宣言する。

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Japanese Language Declaration

委任状：私は、下記発明者として、以下の代理人をここに選任し、本願の手続を遂行すること並びにこれに関する一切の行為を特許商標庁に対して行うことを委任する。
（代理人氏名および登録番号を明記のこと）

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (*list name and registration number*)

Randall J. Knuth
Reg. No. 34,644

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同発明者の署名　日付	Inventor's signature　Date M. Takahashi　20th. Jun 1997
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第２の共同発明者の氏名（該当する場合）	Full name of second joint inventor, if any
同第２発明者の署名　日付	Second Inventor's signature　Date
住所	Residence
国籍	Citizenship
郵便の宛先	Post Office Address

（第六またはそれ以降の共同発明者に対しても同様な情報および署名を提供すること。）

(Supply similar information and signature for third and subsequent joint inventors.)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application:	)	
Migaku Takahashi	)	Group Art Unit: 1753
Serial No: 08/765,836	)	
Filed: January 14, 1997	)	Examiner: G. Cantelmo
TITLE: MAGNETIC THIN FILM AND PRODUCTION METHOD THEREFOR	)	

ASSOCIATE POWER OF ATTORNEY

Commissioner of Patents and Trademarks
Washington, D.C. 20231

Dear Sir:

I hereby appoint: Stephen J. Weyer, Registration No. 43,259, whose post office address is 3510-A Stellhorn Road, Fort Wayne, IN 46815-4631, as my associate attorney in the above-entitled application, to prosecute this application, to make alterations and amendments therein, and to transact all business in the Patent and Trademark Office connected therewith.

Please continue to address all future communications to:

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Respectfully submitted,

Randall J. Knuth
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Date: Feb 24, 1999